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coral faunas. This character is enhanced by the persistence of types; but still the representative faunas are separable by vast intervals of time.—*Proceedings of the Royal Society.*

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## ON THE FOOD AND HABITS OF SOME OF OUR MARINE FISHES.

BY PROFESSOR A. E. VERRILL.

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WHEN we consider the great importance and extent of our fisheries, it seems very remarkable that so little reliable information has been recorded concerning the habits, even of our most common and important species of fishes. It is certainly true that the habits of fishes, and especially of marine fishes, are more difficult to observe than those of birds and beasts, but this ought not to be a sufficient excuse at the present day, for the marked neglect of this department of Natural History. The nature of the food of the more abundant species, even including those that are most commonly sold as food, is still very imperfectly known. Observations must be made in great numbers in various localities and at all seasons of the year before we can obtain adequate knowledge of this subject.

During several years past I have improved such opportunities as have occurred to make observations of this kind, and although they are very incomplete, and often isolated, I am induced to present some of the facts thus ascertained; hoping that the attention of others may be directed to the same subject.

While spending a few days at Great Egg Harbor, on the coast of New Jersey, in April of this year, I dissected the stomachs of many specimens of the common fishes, which were at that time being taken in seines in the shallow waters of the bay, near Beesley's Point. The following were the principal results, in regard to their food. The Striped-bass or "Rock" (*Roccus lineatus* Gill) had its stomach filled with large quantities of shrimp (*Cragon vulgaris*) unmixed with any other food. This shrimp is very abundant on all sandy bottoms in shallow water along the whole coast, from Labrador to Cape Hatteras, and seems to contribute very largely to the food of many of our most valuable fishes.

White Perch (*Merone Americana*) contained the same shrimp in abundance.

Weak-fish (*Cynoscion regalis* Gill), called "Blue-fish" at that locality had its stomach filled with the same Crangon.

Kingfish (*Umbrina regalis*), called "Hake" on the New Jersey coast, contained nothing but *Crangon vulgaris*.

Toad-fish or Oyster-fish (*Batrachus tau*). This fish is almost omnivorous. The stomach is large and usually distended with a great variety of food. Young edible crabs (*Callinectes hastatus* Ordw.) up to two inches across, *Crangon vulgaris*, and the common prawn (*Palæmon vulgaris* Say), were the principal articles of diet at that locality; but pipe-fishes (*Syngnathus Peckianus*) six inches long, and the common black Nassa (*Ilyanassa obsoleta*) were often found in their stomachs, as well as various young fishes. Among the latter were specimens of the Anchovy (*Engraulis vittata*). The toad-fish is, therefore, a fish that should not be encouraged.

The Shad (*Alosa tyrannus* Gill) contained large quantities of fragments of small crustacea, chiefly a small shrimp-like species (*Mysis Americanus* Smith) which was also captured alive in tide-pools on the salt marsh. The shad from the mouth of the Connecticut River, taken in May, contained the same, or another allied species of *Mysis*. Some of the shad also had fragments of eel-grass (perhaps accidental) mixed with the crustacean fragments.

The "Hickory Shad" (*Meletta Mattawocca*), the young called "Herring" at the locality, were also filled with comminuted crustacea, among which the common shrimp (*Crangon vulgaris*) could be recognized most commonly.

The Moss-bunker or Menhaden (*Brevoortia Menhaden* Gill), invariably had its stomach and voluminous intestine filled with the soft, oozy mud, containing a large proportion of organic matter, which abounds in the quiet part of this and all similar bays along the coast. This fish appears, therefore, to obtain its nutriment by swallowing the mud and digesting the organic particles contained in it,—a mode of feeding for which its complex digestive apparatus and toothless mouth are specially adapted. Many marine worms, bivalve mollusks, and echinoderms feed upon the same kind of food, which is everywhere abundant. The moss-bunker is often infested by a large parasitic Lernean (*Lernocera radiata* Les.) which buries its star-shaped head deeply in the flesh.

The "Summer Flounder" (*Chænopsetta ocellaris*) contained abundance of shrimp (*Crangon vulgaris* and *Mysis Americanus*). In one specimen we found a full-grown *Gebia affinis* Say.

The Spotted Flounder (*Lophopsetta maculata* Gill) feeds largely upon crustacea of various kinds. Many specimens contained large quantities of shrimp and prawns (*Crangon vulgaris*, *Palæmon vulgaris* and *Mysis Americanus*). The latter often made up the bulk of the contents of the stomach. In addition to these *Gammarus mucronatus* Say and *Gebia affinis* Say were sometimes found. The *Gebia* we obtained in considerable numbers by digging them out of their long, crooked burrows at low-water mark, near Mr. Peacock's hotel at Beesley's Point. The burrows, which are made in a tenacious clay soil, often with decaying sea-weed beneath, are from half an inch to nearly an inch in diameter, with smooth walls. They are several feet in depth and very long and tortuous. The *Gebia* has a distant resemblance to a young lobster about two or three inches long. The real lobster was not found on the New Jersey coast. The other species of crustacea found in the fishes above named, are all common in the shallow waters of the bay among eel-grass, with the exception of the *Crangon vulgaris*, which frequents the open sandy bottoms, living half buried in the sand, with which its color exactly accords, furnishing an excellent illustration of imitative adaptation for protection.\*

*Ophidium marginatum* DeKay. This species appears to be very rare and its habits little known. We dug two specimens out of the sand near low-water mark, where they burrowed to the depth of a foot or more. When placed upon moist sand they burrowed into it *tail foremost* with surprising rapidity, disappearing in an instant.

At Fire Island on the southern side of Long Island, Mr. S. I. Smith observed last August a species of worm (*Heteronereis*) of a reddish color and two or three inches long, swimming in large numbers at and near the surface. These were at that time the favorite food of the Blue-fish (*Temnodon saltator*).

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\*Many other crustacea of our coast afford similar instances. *Palæmon vulgaris* by its transparency and peculiar tints is scarcely distinguishable among eel-grass; *Idotea irrorata* imitates in all its varied patterns of color the eel-grass and sea-weeds on which it lives; *I. caeca* imitates the color of sand; two species allied to *Spheroma* imitate the colors of the rocks and white barnacles among which they live; *Crangon boreas* of the northern coast, imitates the colors of the red Nullipores among which it seeks concealment, as do also several species of *Hippolyte*, *Chiton ruber* and *C. marmoreus*, *Ophiopholis aculeata* and *Ophioglypha robusta*. Numerous other instances might be given.

At Eastport, Me., and Grand Menan during several years past, I have made many observations on this subject, but mostly relating to fishes of which the habits are better known, like the cod, hake, haddock, etc.

The Wolf-fish (*Anarrhicas vomerinus*) is not at all particular as to its food. At Eastport I took from the stomach of a large one at least four quarts of the common round sea-urchin (*Euryechinus Dröbachiensis* V.), most of them with the spines on, and many of them quite entire. From another, I took an equal quantity of a mixture of the same sea-urchin and the large whelk (*Buccinum undulatum*). Many of the latter were entire or but slightly cracked.

The Sculpins not unfrequently swallow entire large specimens of several crabs (*Cancer irroratus*, *Hyas coarctatus*, etc.).

The Haddock is addicted to the same habit, but is a very general feeder, swallowing all sorts of mollusca, worms, fishes, etc.

The Herring (*Clupea elongata*) in the Bay of Fundy feeds very extensively, at least during all the months when I have observed them (June to November), upon several species of *Mysis* and *Thysanopoda*, called "shrimp" by the fishermen. These swim free at and near the surface in extensive "schools" and are persistently pursued by the Herring. The commonest species, apparently a *Thysanopoda*, is about an inch and a half long, of a pale reddish color. The species of *Mysis* are smaller and paler. The two genera often occur together. Young Pollock or Coal-fish, four to ten inches long, pursue the same species in large schools, often coming around the wharves of Eastport in great numbers in eager pursuit of their prey, and by leaping out after them produce a great commotion in the water. When thus pursued the *Thysanopoda* will leap out of the water to the height of a foot or more. The common *Sebastes*, or "Red Perch" at Eastport, feeds upon the same species when they come around the wharves, but probably does not pursue them to the same extent as the herring and pollock.

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## POLYMORPHIC FUNGI.

BY M. C. COOKE.

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It is now generally admitted that a great many fungi, formerly regarded as good and distinct species, are in reality, only conditions